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(54) **Opening and closing system for washing and/or drying machines**

(57) An opening and closing system for washing and/or drying machines (1) of the front-loading type comprises a seal (4) which surrounds the loading aperture (3) of the washing machine and a door (5) attached to the support structure (2) of the washing machine in a manner fixed in rotation and slidable between an open position and a closed position, in which a contact surface (6) of the door (5) adheres to the seal (4), closing the loading aperture (3) in a leaktight manner. The contact surface (6) and the seal (4) are substantially parallel and inclined relative to the direction of sliding (S) of the door (5).

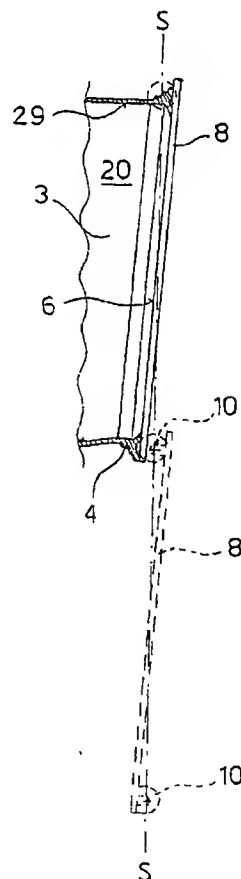


FIG. 3

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Description

[0001] The present invention relates to an opening and closing system for washing and/or drying machines of the front-loading type.

[0002] As is known, washing machines of the front-loading type, in particular those for domestic use, possess a support and containment structure having a front wall provided with an aperture for the loading and unloading of the laundry. The said loading aperture is closed in a leaktight manner by a door fixed to the said front wall.

[0003] The known opening and closing systems for washing machines are subdivided into two main groups: systems having a hinged door and systems having a sliding door.

[0004] In the systems having a hinged door, the opening and closing of the loading aperture takes place by means of the movement of the door in accordance with the principle of a leaf-type door, with the disadvantage of being very space consuming at the front in the open position and requiring substantial space for the movement of the said door.

[0005] In addition to being space consuming, the washing machines of the known art expose, in the open state, structural parts which normally face towards the interior of the domestic electrical appliance and which should not be accessible to the user. These structural parts may be very hot and soaked with washing liquid, or angular and therefore dangerous or at least annoying.

[0006] In the systems having a sliding door, the door is fixed to the support structure of the domestic electrical appliance, for example by means of rocking levers, in a manner such as to produce a translatory movement of the door, which, in order to achieve reliable closing of the loading aperture, comprises, during opening, an initial phase of moving away and, during closing, a final phase of moving towards the front wall of the washing machine.

[0007] Such systems having a sliding door, although less bulky than the systems having a hinged door, comprise very complex and costly mechanisms for moving the door and also prove to be somewhat weak, and unsatisfactory from an aesthetic standpoint.

[0008] It is therefore an object of the present invention to provide an opening and closing system for washing machines having features such as to overcome the disadvantages quoted in connection with the known art.

[0009] This and other objects are achieved by an opening and closing system for washing and/or drying machines of the type comprising a support structure and a tub/basket assembly provided with a loading aperture, wherein the said opening system comprises a rim which defines the said loading aperture and a door attached to the said support structure in a manner fixed in rotation and slidable between an open position, which permits access to the loading aperture, and a closed position, in which a contact surface of the door adheres to the

said rim, closing the loading aperture in a leaktight manner, wherein the said contact surface and the rim are substantially parallel and inclined relative to the direction of sliding of the door.

5 [0010] For greater ease of understanding of the invention, a description is given below, by way of example and without implying any limitation, of various embodiments thereof that are illustrated in the attached drawings, in which:

10 [0011] Figure 1 is a schematic frontal view of a first embodiment of the system according to the invention;

[0012] Figure 2 is a schematic frontal view of a second embodiment of the system according to the invention;

15 [0013] Figure 3 is a view in section along the line III-III in Figure 2, showing only certain details of the system according to the invention;

[0014] Figure 4 is a view in section along the line IV-IV in Figure 2, showing only certain details of the system according to the invention;

20 [0015] Figure 5 is a view in section along the line V-V in Figure 1, which shows a further embodiment of the invention.

[0016] With reference to the figures, a washing or drying machine, especially a washing machine of the front-loading type, is designated as a whole by 1. The said washing-machine 1 comprises a support structure 2, a tub/basket assembly (not shown in the figures) provided with a loading aperture 3, and an opening and closing system for opening and closing the said loading aperture 3, hereinafter referred to as an opening system.

30 [0017] The said opening system comprises a rim which defines the loading aperture 3 and a door 5 attached to the said support structure 2 in a manner fixed in rotation and slidable between an open position (shown in broken lines in Figure 3), which permits access to the loading aperture 3, and a closed position, in which a contact surface 6 of the door 5 adheres to the said rim, closing the loading aperture 3 in a leaktight manner. Advantageously, the abovementioned rim is formed by a seal 4 which surrounds the loading aperture 3.

40 [0018] The contact surface 6 and the seal 4 (or more generally the rim of the loading aperture 3) are substantially parallel and inclined relative to the direction of sliding S of the door 5, in a manner such as to produce, in the closed position, an inclined and leaktight end-of-travel stop, ensured by pressure of the said contact surface 6 against the seal 4 which is substantially uniform and dependent upon the sliding position of the door 5.

50 [0019] Advantageously, the contact surface 6 forms an angle of between 1° and 10°, preferably 4°, with the direction of sliding S of the door 5.

[0020] In accordance with one embodiment of the invention, the sliding path (or, in other words, the direction of sliding S) of the door 5 is substantially rectilinear, preferably parallel relative to a front wall 7 of the support structure 2.

55 [0021] As is apparent from the figures, the door 5 ad-

vantageously comprises a plate 8 which is substantially flat and inclined relative to the direction of sliding S, and whose surface facing the interior of the support structure 2 forms the said contact surface 6.

[0022] In accordance with one embodiment, the said plate 8 is produced from glass or plexiglass and preferably possesses a substantially rectangular or square shape.

[0023] In accordance with a further embodiment (not shown in the figures), the door 5 comprises a plate of glass or the like supported by a frame or framework element, which is advantageously but not necessarily formed by an internal portion, applied to the internal surface of the said glass plate, and an external portion, applied to the external surface of the glass plate, wherein the said internal and external portions are connected to one another in order to form the said frame of the door.

[0024] In order to produce the sliding movement of the door 5, suitable sliding members are provided, preferably wheels 10 or alternatively sliding tongues or the like, fixed to the door 5 at two opposite lateral sides 9, 9' and capable of sliding along suitable sliding guides 11, 11' associated with the support structure 2.

[0025] Advantageously, each of the two opposite lateral sides 9, 9' of the door 5 is provided with, respectively, two sliding members, in particular wheels 10, spaced apart in the direction of sliding S and slidingly supported by, respectively, two parallel sliding guides 11, 11'.

[0026] Advantageously, the distance between the sliding members 10 in the direction of sliding S is substantially equal to the diameter of the loading aperture 3, in a manner such as to obtain a regular support of the door 5 at four points.

[0027] In accordance with one embodiment, the door 5 additionally possesses an external surface 12 facing the exterior of the support structure 2 and substantially parallel to the said front wall 7.

[0028] Advantageously, the non-functional spaces resulting from the arrangement and orientation of the retention and sliding planes may be freely used to give the domestic electrical appliance any aesthetic form desired.

[0029] In the examples reproduced in the figures, the wheels 10, 10' are fixed to the door 5 in a manner such as to lie in a plane that is inclined relative to the said contact surface 6, wherein the inclination of the plane of the wheels 10, 10' relative to the contact surface 6 corresponds to the inclination of the contact surface 6 relative to the direction of sliding S. This permits the use of a single plane of sliding, produced, for example, by means of the abovementioned two parallel sliding guides 11 and 11'.

[0030] Alternatively, the sliding members, in particular sliding tabs, may be disposed in a manner such as to lie in a plane parallel or identical to the contact surface 6, wherein the inclination of the contact surface 6 relative to the direction of sliding S is produced by means

of different sliding planes for the upper and for the lower sliding members.

[0031] In accordance with one embodiment, the sliding guides 11, 11' comprise two parallel rectilinear profiles having a U-shaped or C-shaped cross-section, capable of slidingly supporting the said sliding members 10 and 10'.

[0032] The sliding guides 11, 11' are connected to the support structure 2, preferably to the front wall 7, in a manner such as to extend laterally on two opposite sides of the loading aperture 3 and, preferably, parallel relative to the said front wall 7.

[0033] A further embodiment, reproduced for example in Figure 5, envisages that the front wall 7 comprises a cover panel 13 provided with an aperture 14 in alignment with the loading aperture 3, and that the door 5 is disposed between the said cover panel 13 and the tub/basket assembly (not shown in the figures) in a manner such that, in the open position, the door 5 is at least partially covered by the cover panel 13 and, in the closed position, the door 5 is disposed in alignment with the said aperture 14.

[0034] The said cover panel 13 may be a component of the washing machine 1, for example the front wall 7 or part thereof, or a part of the closing system, capable of being associated with the support structure 2 in general or with the front wall 7 in particular.

[0035] In accordance with one embodiment, the external surface 12 of the door 5 is parallel to and so far as possible aligned with the external surface of the cover panel 13 to produce, in the closed position, a front external surface of the washing machine 1 which is substantially smooth and continuous.

[0036] In accordance with a further development of the invention, a collecting tank (not shown in the figures) is provided, disposed between the said cover panel 13 and the tub/basket assembly and below the loading aperture 3 and the door 5, to collect washing liquid which has dripped from the contact surface 6 or any other leakages of washing liquid.

[0037] In accordance with one embodiment, reproduced for example in Figure 2, automatic actuation means are provided, preferably an electric motor 15 connected to the door 5 by means of a flexible cable or belt 16, for actuating the said door 5. Alternatively, the said automatic actuation means comprise hydraulic or pneumatic lifting cylinders.

[0038] In accordance with a further embodiment, braking means are provided, capable of braking and/or damping the said sliding movement of the door 5 between the closed position and the open position.

[0039] In the case where the door 5 slides in a direction substantially vertical relative to the operating position of the washing machine 1, the said braking means advantageously comprise one or more weights 17, connected to the door 5 by means of a flexible cable 18 passed around a pulley 19, in a manner such as to exert a force in the direction of sliding S opposed to the grav-

itational force of the door 5.

[0040] Advantageously, these weights are configured in a manner such that the door 5 is in equilibrium in any intermediate position between the said open and closed positions, requiring a minimal effort on the part of the user to move the door 5.

[0041] The flexible cables 16 and 18 advantageously, but not necessarily, extend within the sliding guides 11, 11'.

[0042] In accordance with a further embodiment, the seal 4 possesses an internal surface 29 which is substantially abrasion-resistant, and defines, together with the contact surface 6 of the door 5, an additional space 20 for the laundry to be washed. In order further to increase the volume of the said additional space 20, the contact surface 6 could be curved towards the exterior of the support structure 2. Advantageously, the said curvature applies only to the zone of the contact surface 6 within the sealing zone as such.

[0043] Advantageously, the portion of the door 5 intended to be placed over the loading aperture 3 is produced as a substantially transparent window and, even more advantageously, the portion of the door 5 intended to be placed over the seal 4 is produced as a substantially opaque frame.

[0044] In accordance with one embodiment, the plate 8 itself comprises a substantially transparent central portion which functions as a window, and an opaque peripheral zone, which is for examples painted or polished or roughened, on the surface opposite the contact surface 6, which functions as a frame.

[0045] A description is given below of the operation of the opening system according to the invention.

[0046] During the laundry washing cycle, the door 5 is disposed in the closed position and the seal 4 adheres to the contact surface 6 of the door 5 by means of a substantially uniform circumferential pressure, depending on the final sliding position of the said door 5.

[0047] The door 5 is locked in the said closed position by means of locking means 24 (shown schematically in Figures 1 and 2), for example a hook, associated with the door 5, which engages, preferably by snap fitting, with a counter-hook of the support structure 2, fixed, for example, to the front wall 7.

[0048] During the washing cycle, the washing programme keeps a door-locking system activated, which prevents the disengagement of the locking means and, consequently, any opening movement of the door 5.

[0049] After the completion of the washing cycle, the locking means are disengaged, for example by means of an opening button 21 disposed in a control panel 22 of the washing machine, and the door 5 slides from the closed position into the open position, by virtue of the force of gravity or by means of automatic actuation means, for example by means of the electric motor 15, or manual actuation means, for example by means of a handle 21 disposed on the external surface 12 of the door 5.

[0050] The sliding movement of the door 5 is advantageously controlled by means of the counterweights 17 or other braking or damping and balancing means.

[0051] By virtue of the inclination of the seal 4 and the contact surface 6 relative to the direction of sliding S, the said contact surface 6 disengages and moves away from the seal 4 with the sliding of the door 5 towards its open position, without even minimally increasing the frontal space occupation of the washing machine 1. It is particularly advantageous to incline the loading aperture 3 with the seal 4 downwards and, consequently, the contact surface 6 of the door 5 upwards, allowing a downward opening movement of the door 5, assisted by the force of gravity, and a closing movement thereof against the said force of gravity, which is therefore very easy to control.

[0052] Advantageously, the door 5 slides in the space between the cover panel 13 and the tub/basket assembly.

[0053] The closing of the loading aperture 3 takes place in a similar manner, with the door 5 being pulled from the open position into the closed position, in which it is locked, preferably by snap fitting, by means of the abovementioned locking means 24.

[0054] In order to prevent the edge of the seal 4 being folded over during the final phase of closing, in which the contact surface 6, although already adhering to the seal, performs a further sliding movement in order to increase the retention pressure, provision is advantageously made for the most affected points of the seal 4 to be strengthened or thickened.

[0055] In accordance with the forms of embodiment reproduced in Figures 1 and 2, the seal 4 possesses such a thickened portion 23 in the part thereof facing the open position of the door 5, in particular in the lower part.

[0056] The opening and closing system according to the present invention possesses numerous advantages.

[0057] The space requirement of the washing machine 1 equipped with the present opening system is greatly reduced, and does not vary during the movement of the door 5. This allows a gain of space which can be used, for example, to increase the volume of the tub/basket assembly of the washing machine.

[0058] Furthermore, the opening system according to the present invention is very pleasing aesthetically, very simple structurally and particularly strong, and ensures optimum retention as a result of the regular support of the door at four points.

[0059] The opening system according to the invention has been described and illustrated with reference to a washing machine, but it can be equally advantageously applied to dishwashers, tumble dryers and cooking ovens comprising a support structure 2 and a loading or access aperture 3.

[0060] Obviously, a person skilled in the art, in order to satisfy contingent and specific requirements, will be able to introduce further modifications and variations to

the opening and closing system according to the present invention, all such changes however being contained within the scope of protection of the invention, as defined by the claims that follow.

Claims

1. Opening and closing system for washing and/or drying machines (1) of the type comprising a support structure (2) and a tub/basket assembly provided with a loading aperture (3), wherein the said opening system comprises a rim which defines the said loading aperture (3) and a door (5) attached to the said support structure (2) in a manner fixed in rotation and slidable between an open position, which permits access to the loading aperture (3), and a closed position, in which a contact surface (6) of the door (5) adheres to the said rim, closing the loading aperture (3) in a leaktight manner, wherein the contact surface (6) and the rim are substantially parallel and inclined relative to the direction of sliding (S) of the door (5). 5
2. Opening system according to Claim 1, wherein the said rim is formed by a seal (4) which surrounds the said loading aperture (3). 10
3. Opening system according to Claim 1 or 2, wherein the sliding path of the door (5) is substantially rectilinear. 15
4. Opening system according to Claim 1, 2 or 3, wherein the said contact surface (6) forms an angle of between 1° and 10°, preferably 4°, with the direction of sliding (S) of the door (5). 20
5. Opening system according to one of the preceding claims, wherein the said direction of sliding (S) of the door (5) extends substantially parallel to a front wall (7) of the support structure (2). 25
6. Opening system according to any one of the preceding claims, wherein the door (5) comprises a plate (8) which is substantially flat and inclined relative to the direction of sliding (S), and whose surface facing the interior of the support structure (2) forms the said contact surface (6). 30
7. Opening system according to any one of the preceding claims, wherein the door (5) comprises sliding members (10, 10') which are slidably retained by sliding guides (11, 11') associated with the said support structure (2). 35
8. Opening system according to Claim 7, wherein the door (5) comprises two first sliding members (10), preferably wheels, spaced apart in the direction of sliding (S) and respectively associated with one (9) of two opposite lateral sides (9, 9') of the door (5) and two second sliding members (10'), preferably wheels, spaced apart in the direction of sliding (S) and respectively associated with the other (9') of the said two opposite lateral sides (9, 9') of the door (5), wherein the said sliding guides (11, 11') comprise two parallel sliding guides (11, 11') which slidably retain the said first and second sliding members (10). 40
9. Opening system according to any one of the preceding claims, wherein the said door (5) possesses an external surface (12) facing towards the outside of the support structure (2), the said external surface (12) being substantially parallel to the said front wall (7). 45
10. Opening system according to any one of Claims 7 to 9, wherein the said sliding guides (11, 11') are rectilinear metal profiles having a U-shaped or C-shaped cross-section. 50
11. Opening system according to any one of the preceding claims, wherein the direction of sliding (S) of the door (5) is substantially vertical relative to the operating position of the washing machine (1). 55
12. Opening system according to any one of the preceding claims, comprising a cover panel (13) associated with or formed by the front wall (7) and provided with an aperture (14) in alignment with the loading aperture (3), wherein the door (5) is disposed between the said cover panel (13) and the tub/basket assembly in a manner such that, in the open position, the door (5) is at least partially covered by the cover panel (13) and, in the closed position, the door (5) is disposed in alignment with the aperture (14) of the said cover panel (13).
13. Opening system according to any one of the preceding claims, comprising automatic actuation means (15, 16), preferably an electric motor (15) connected to the door (5) by means of a flexible cable (16), for actuating the said door (5).
14. Opening system according to any one of the preceding claims, comprising braking means (17, 18) capable of braking and/or damping and/or balancing the sliding movement of the door (5) between the closed position and the open position.
15. Opening system according to Claim 14, wherein the said braking means (17, 18, 19) comprise one or more counterweights (17), connected to the door (5) by means of a flexible cable (18) passed around a pulley (19), in a manner such as to exert a force in the direction of sliding (S) opposed to the gravi-

tational force of the door (5).

16. Opening system according to any one of the preceding claims, wherein the internal surface (29) of the seal (4), which is preferably reinforced and abrasion-resistant, and the contact surface (6) of the door (5) define an additional space (20) for the laundry to be washed. 5
17. Opening system according to Claim 16, wherein the contact surface (6) of the door (5) is curved outwards to increase the volume of the said additional space (20). 10
18. Opening system according to any one of the preceding claims, wherein the door (5) comprises a substantially transparent window portion, intended to be placed over the loading aperture (3). 15
19. Opening system according to any one of the preceding claims, wherein the door (5) possesses a substantially opaque frame portion, which can be placed over the seal (4). 20
20. Opening system according to any one of the preceding claims, wherein the seal (4) possesses, in its part facing the open position of the door (5), in particular in the lower part, reinforcing means (23) for reinforcing the seal (4). 25
21. Opening system according to any one of the preceding claims, wherein the said reinforcing means (23) comprise a thickened portion (23). 30
22. Opening system according to any one of the preceding claims, wherein the said door comprises a plate of glass or the like supported by a frame element. 35
23. Washing and/or drying machine (1), comprising an opening system according to any one of the preceding claims. 40
24. Cooking oven (1) comprising a support structure (2) and a loading or access aperture (3), **characterized in that** it comprises an opening system according to any one of Claims 1 to 22. 45

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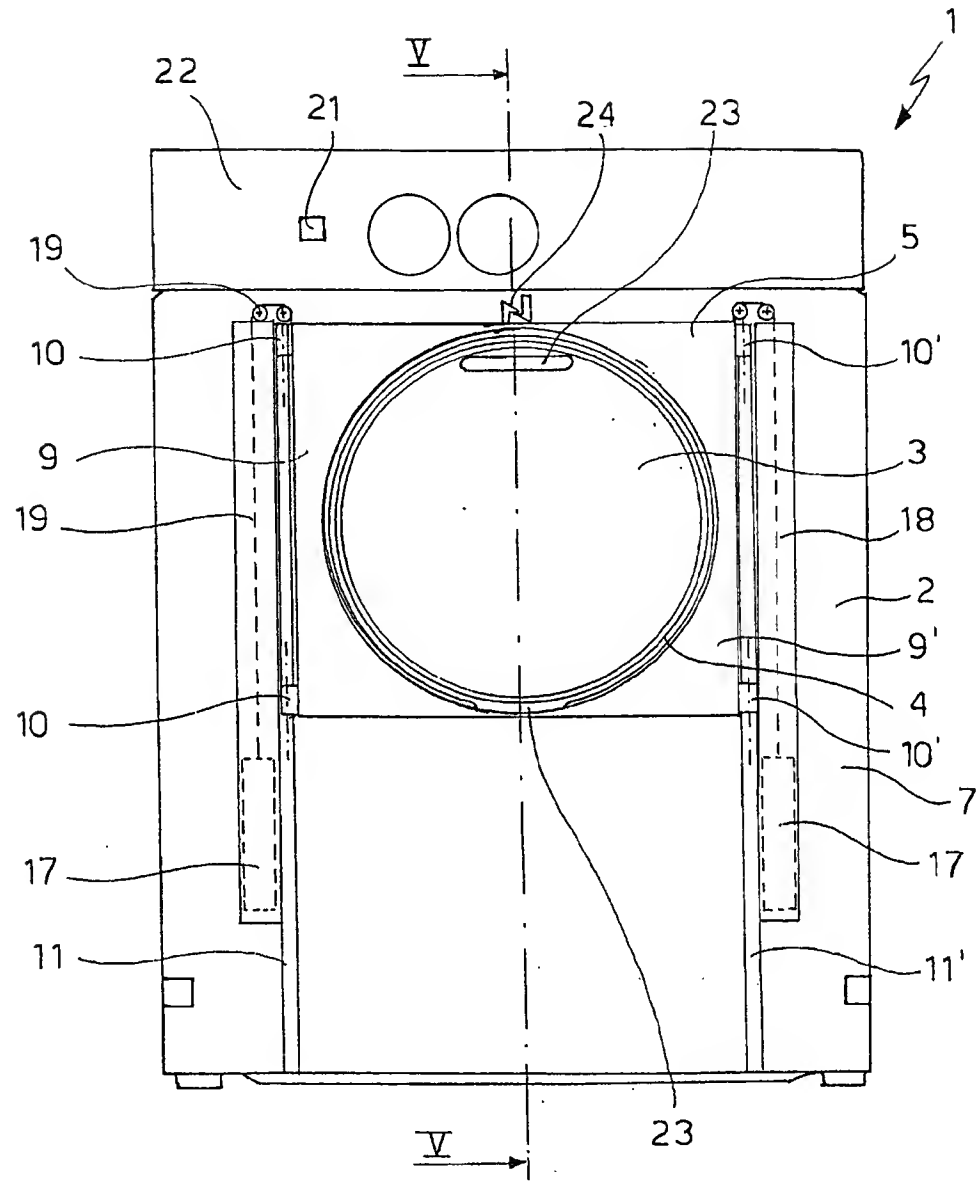


FIG. 1

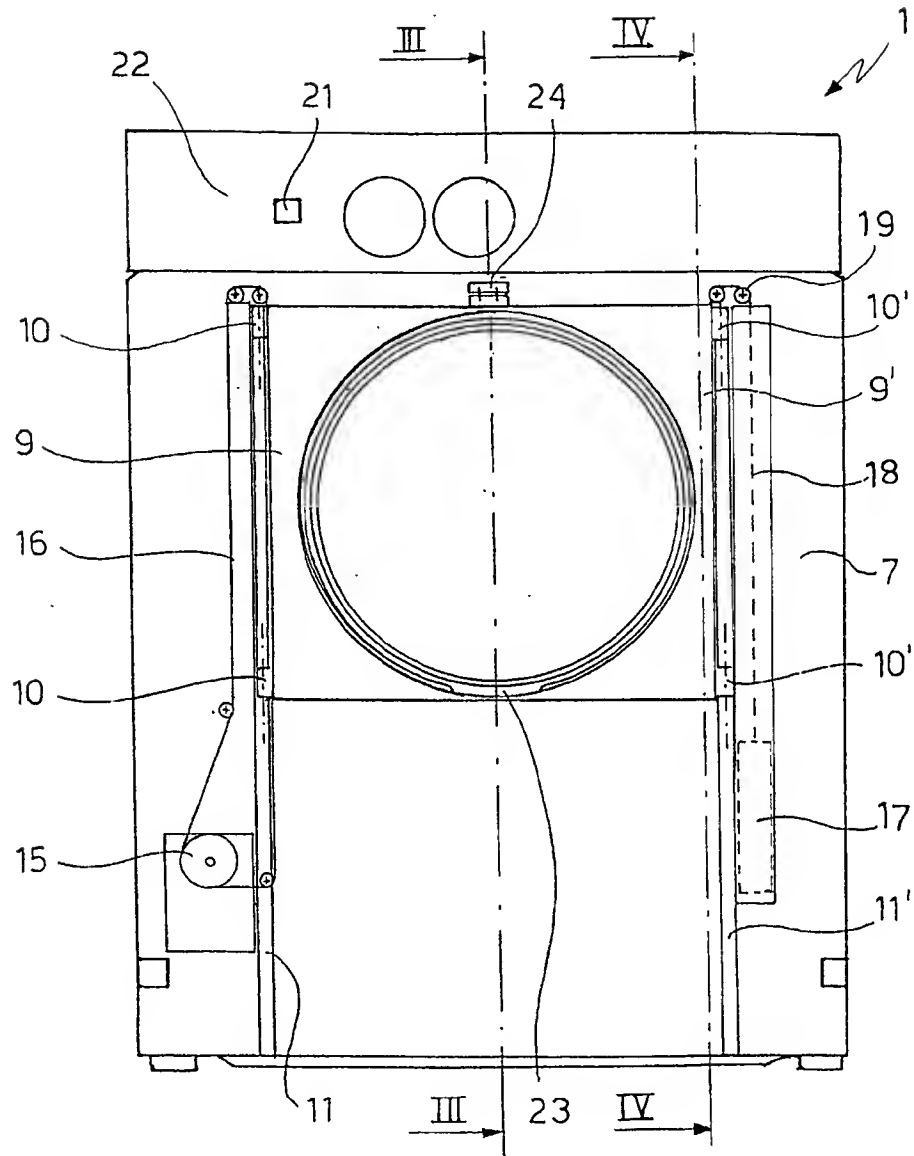


FIG. 2

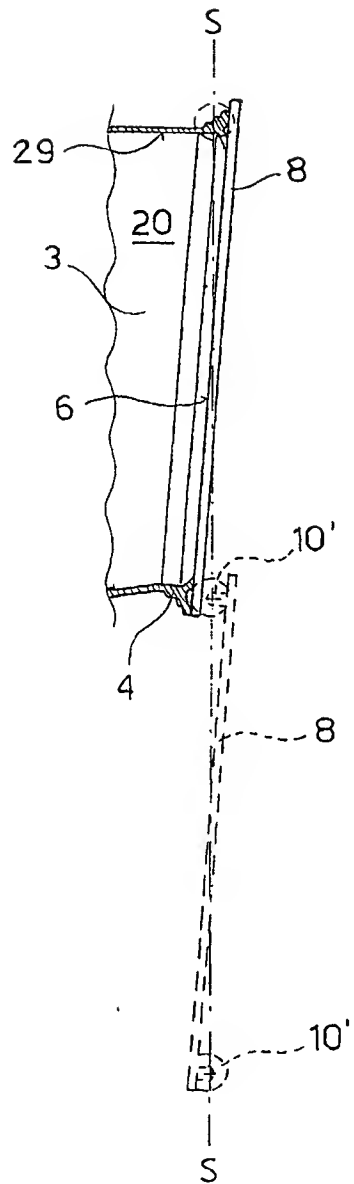


FIG. 3

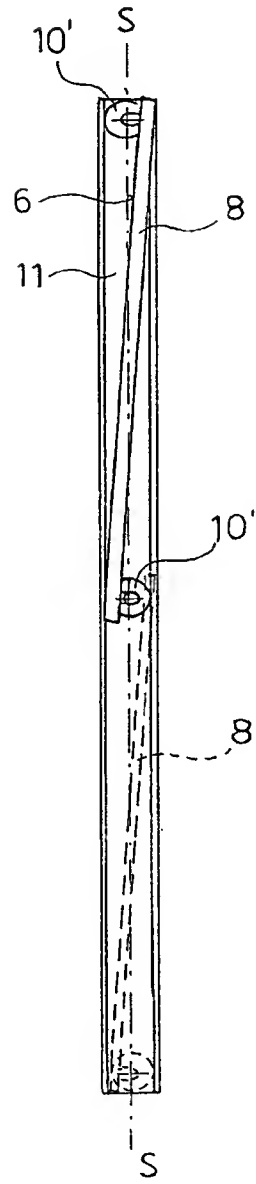


FIG. 4

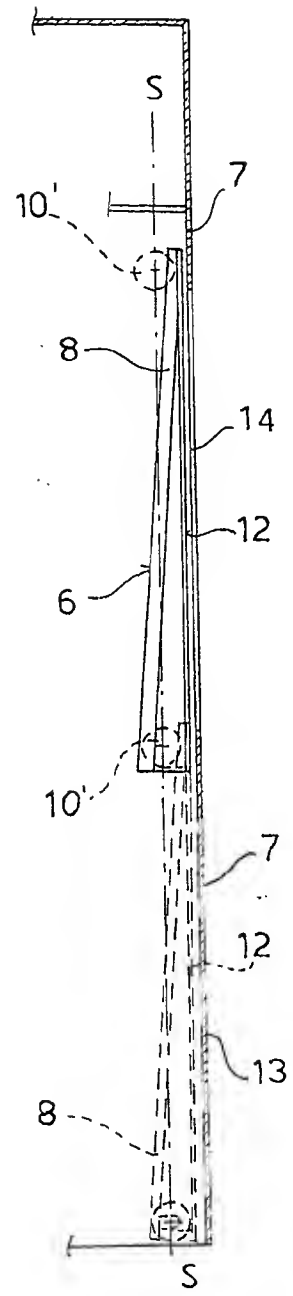


FIG. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 02 42 5602

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	WO 02 12613 A (ARCELIK AS ;BUEKUELMEZ BORA (TR); KUTLAY ENGIN (TR)) 14 February 2002 (2002-02-14) * the whole document *	1-24	D06F39/14
A	DE 197 38 458 A (AEG HAUSGERAETE GMBH) 4 March 1999 (1999-03-04) * the whole document *	1-24	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			D06F A47J
The present search report has been drawn up for all claims			
Place of search MUNICH		Date of completion of the search 27 January 2003	Examiner Cagnoli, M
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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 02 42 5602

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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27-01-2003

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